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(54) Grid lagging for a tunnel lining.

(57) The present invention relates to an autolocking coating for road tunnels and the like, characterized in that it comprises a plurality of preformed panels made of a metal net grid assembly which is provided, on two opposite sides thereof, with ccoupling members for engaging with two side longitudinal guides supported between the ribs of a supporting frame.

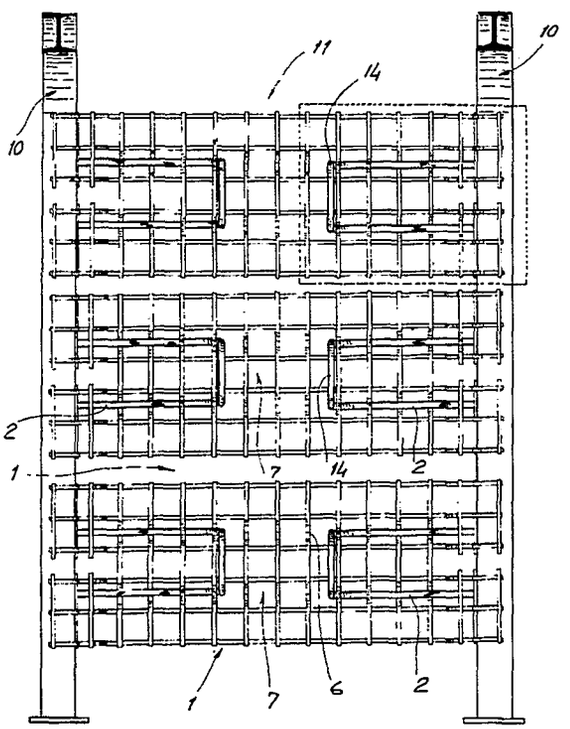

Fig.1

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AUTOLOCKING COATING FOR ROAD TUNNELS AND THE LIKE

BACKGROUND OF THE INVENTION

The present invention relates to an auto or self-locking coating for making road tunnels and the like.

As is known, in order to bore and simultaneosly lining road tunnels, there is generally used a full section shield, and there are frequently employed, in a constantly increasing manner, several different boring milling cutters.

Conventional boring methods, however, also frequently use boring explosives and supporting ribs for supporting the walls of the tunnel being formed, as well as a lining system, arranged between the single rib pairs, usually consisting of a net and "spritz-beton" assembly or the like metal supporting members.

In particular, for lining tunnels, there is usually laid a temporary supporting frame, made of steel ribs, or a temporary lining made by bolting the wall rock in association with a great thickness of reinforced concrete, reinforced with a metal net, which must be anchored to the tunnel wall rock by means of bolts.

Thus, the lining operations are very complex and require a very long time and great amount of labour, with consequent practical making problems, depending on the lining method, in particular on the use of quoins(of reinforced concrete, stone and the like), metal plates or reinforced concrete to be directly poured during the boring of the road tunnel.

SUMMARY OF THE INVENTION

Accordingly, the aim of the present invention is to overcome the above mentioned drawbacks, by providing a coating or lining for tunnels which can greatly simplify the lining operations of road tunnels which are finished after boring.

Within the scope of the above aim, a main object of the present invention is to provide such a road tunnel lining which can be installed without using specifically designed mechanical apparatus and which can be quickly and safely applied to the walls and ceiling of the tunnels in very safe long lasting conditions for the operators.

Another object of the present invention is to provide such a road tunnel lining which can be made starting from easily available elements and materials and which, moreover, is very advantageous from a mere economic standpoint.

According to one aspect of the present invention, the above mentioned aim and objects, as well as yet other objects, which will become more apparent hereinafter, are achieved by an auto-locking lining for road tunnels and the like, characterized in that said lining comprises a plurality of preformed panels, made of a metal net grid assembly provided, on two opposite sides thereof, with coupling means for engaging with two longitudinal guides supported by ribs of a tunnel supporting frame.

BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics and advantages of the present invention will become more apparent from the following detailed description of some preferred embodiments of the invention, which are illustrated, by way of an indicative but not limitative examples, in the figures of the accompanying drawings, where:

figure 1 is a front view of the panel road tunnel lining according to the present invention, applied on tunnel guides;

figure 2 is a perspective axonometric view of a single lining panel;

figures 3 and 4 show a detail of the coupling zone to a side guide, respectively in top plan view and cross-sectional view;

figures 5 to 10 schematically show the method step for applying the panel lining;

figure 11 shows a detail of the panel lining, during the last step of the lining method;

figures 12 and 13 are respectively an elevation view and a top plan view of a different embodiment of a lining panel, the cross round members of an attachement zone thereof being omitted;

figure 14 is a perspective view illustrating a simplified lining panel;

figure 15 schematically shows the profile of the lining panel of figure 14;

figures 16 and 17 shows a procedure for engaging a panel between side guides consisting of a longitudinal double-T beam;

figure 18 is a top view of the road tunnel lining, made by installing a plurality of adjoining lining panels;

figure 19 shown a detail of a cutting operation, performed on a round cross-section member in order to obtain an auto-locking coupling; and

figures 20 and 21 are respectively an elevation and top plan view illustrating lining panels provided with self-locking elements made by cutting or shearing operations.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the figures of the accompanying drawings and, in particular, to figures 1 to 11, the self-locking lining according to the present invention comprises a plurality of lining preformed panels 1, made of a metal net.

These pannels are installed by means of manual means (a conventional hammer) and clamping fork members 2 can be further applied thereon.

As shown the net lining panel contour has a generally C-shape pattern, with diverging legs 3, so that the lining panels can be arranged within the top arch of the tunnel to be lined, and are moreover provided with end portions 4 provided with loop patterns 5.

The metal net of the lining panels 1 has the wires 6 of the net links 7 rich are warped according to the tunnel axis made in a loop configu ration so as to provide eyelets 8 alternately arranged above and under the contour of said lining panels 1.

More specifically said lining panels 1 are installed by nesting or engaging before one of the end portions 4, and then the other, respectively with the loop 5, in the bottom leg 9 of one of the side guides 10, consisting of double-T metal beams.

These side guides 10, in particular, should be mounted, in a longitudinal direction, between two subsequent ribs of the road tunnel supporting frame.

If the tunnel wall rock has a poor consistency, then the preformed panel lining is installed by using the mentioned locking fork members 2, which are designed and sized depending on the consistency of the rock to be supported.

More specifically, these clamping fork members 2 are manually threaded, two for each lining panel 1, from the central zone 11, in a cross direction, into the eyelets 8 formed by the net links 7.

The last step of the installing method consists of engaging each fork member 2 so as to contact the top leg 12 of one of the double-T guides 10.

The installation will be finished as the end portion 13 is arranged at the end of the leg 12, and the handle 14 engages with the net of the lining panel 1.

In this condition, the end edge 15 of the end portion 4 of each panel 1 will be arranged at the web portion 16 of a respective double-T supporting beam 10.

On the installed lining panel a spritz-beton compund will be then applied so as to adhere to the rock and close the void spaces between said rock and the lining net.

During this step, in particular, there are nearly completely eliminated all of the void spaces between the lining and rock thereby providing the lining panels 1, in a very simple way, with a very good consistency while greatly reducing possible volumes to be injection filled.

According to the modified embodiment shown in figures 12 and 13, at the end portions provided with a loop part 5, there is preferably arranged a lining panel devoid of the wires 6 of the net links 7, so as to further facilitate the installation of the lining.

Figures 13 to 21 show a simplified embodiment of the lining panel, herein indicated by the reference number 101, in which said panel has a substantially trapezoidal configuration, with diverging legs 102, so that this panel can be arranged within the arch 103 of the tunnel to be lined.

This panel, in particular, affords the possibility of using a net having any desired link configuration and size, with great diameter net wires, specifically designed for supporting great loads.

This net structure is assembled by engaging at first one and then the other of the end portions 104 on the bottom inner leg 105 of side guides, indicated at 106, which also in this case are advantagesouly formed by double-T metal beams 107.

These side guides must be installed, in a longitudinal direction, between two subsequent ribs of the tunnel supporting frame.

In this connection, it should be pointed out than the even trapezoidal shape, open at the bottom, of the lining panels affords the possibility of easily assembling a plurality of lining panels in a very reduced volume, which greatly simplifies the shipment of the lining panels from the shop to the assembling place.

As shown in figures 19 to 21, it is possible to make on a longitudinal round cross-section rod or wire 120 of a lining panel, at the end portion 104 thereof, an end cut, and separate said rod from the cross rods, so as to bend said rod 120 in order to provide a firmer clamping of the panel with respect to the side guides.

From the above disclosure it should be apparent that the present invention fully achieves the intended aim and objects.

In particular the fact must be pointed out that the lining panels, either 1 or 101, of preformed metal net, require a very small amount of metal material and can be made in a making shop by simple pressing operations, at a very reduced cost.

Another important aspect of the present inven tion is that it provides a temporary lining adapted to operate as a safety supporting arrangement during the boring operations of the tunnel, without the use of heterogeneous materials very different from the reinforced concrete to be used for the finishing lining, this temporary lining being moreover adapt-

ed to efficiently cooperate with the reinforced concrete embedded therein.

Moreover the preformed panels, as none spritzbeton filling and reinforcement compound is used, can be easily recovered and reused.

The panels, furthermore, can be specifically used, by properly fitting them, in association with ribs made of NP, HEB, G.I, T.H and the like ribs,

While the invention has been disclosed and illustrated with reference to preferred embodiment thereof, it should be apparent that the disclosed embodiment are susceptible to several modifications and variations, all of which will become within the spirit and scope of the appended claims,

In practicing the invention the used materials, provided that they are compatible to the intended use, as well as the contingent shapes and size can be any according to requirements,

Claims

1- An autolocking lining for road tunnels and the like, characterized in that said lining comprises a plurality of preformed panels, made of a metal net grid assembly provided, on two opposite sides thereof, with coupling means for engaging with two longitudinal guides supported by ribs of a tunnel supporting frame.

2- A lining according to claim 1, characterized in that said panels have a C-like shape with diverging legs to be arranged within the top arch of the tunnel to be lined and being provided with loop shaped end portions.

3- A lining according to claims 1 and 2, characterized in that said panels has link wires warped according to said tunnel axis of loop shape so as to provide eyelets alternately arranged above and under the contour of said panels.

4- A lining according to one or more of the preceding claims, characterized in that said net panels are assembled by engaging before one and after the other end portion loops in the bottom leg of one of said longitudinal guides consisting of double T metal beams.

5- A lining according to one or more of the preceding claims, characterized in that said lining comprises clamping fork members to be manually engaged, two for panels, from a central zone and in a cross direction, in said eyelets formed by the links of said net, to contact the top leg of one of said double-T beams.

6- A lining according to one or more of the preceding claims, characterized in that one of said end portions is missing, at a part overlying said double-T beams, of some wires.

7- A lining according to one or more of the preceding claims, characterized in that said panel is provided with bent end portions so as to define a substantially trapezoidal contour, said bent end portion diverging outward and being engaged against the bottom leg of said double-T beams forming said longitudinal side guides.

8- A lining according to one or more of the preceding claims, characterized in that said lining further comprises, at said legs, a round cross-section member which longitudinally extends from said panel, being separated from the panel links to be bent and firmly engaged in said longitudinal side guides to operate as a self locking element for said panels.

9- A lining according to one or more of preceding claims, characterized in that said panels are specifically designed for being filled with a spritzbeton compound which is poured so as to cause said panels to firmly adhere to the tunnel rock, by filling the void spaces between said rock and net.

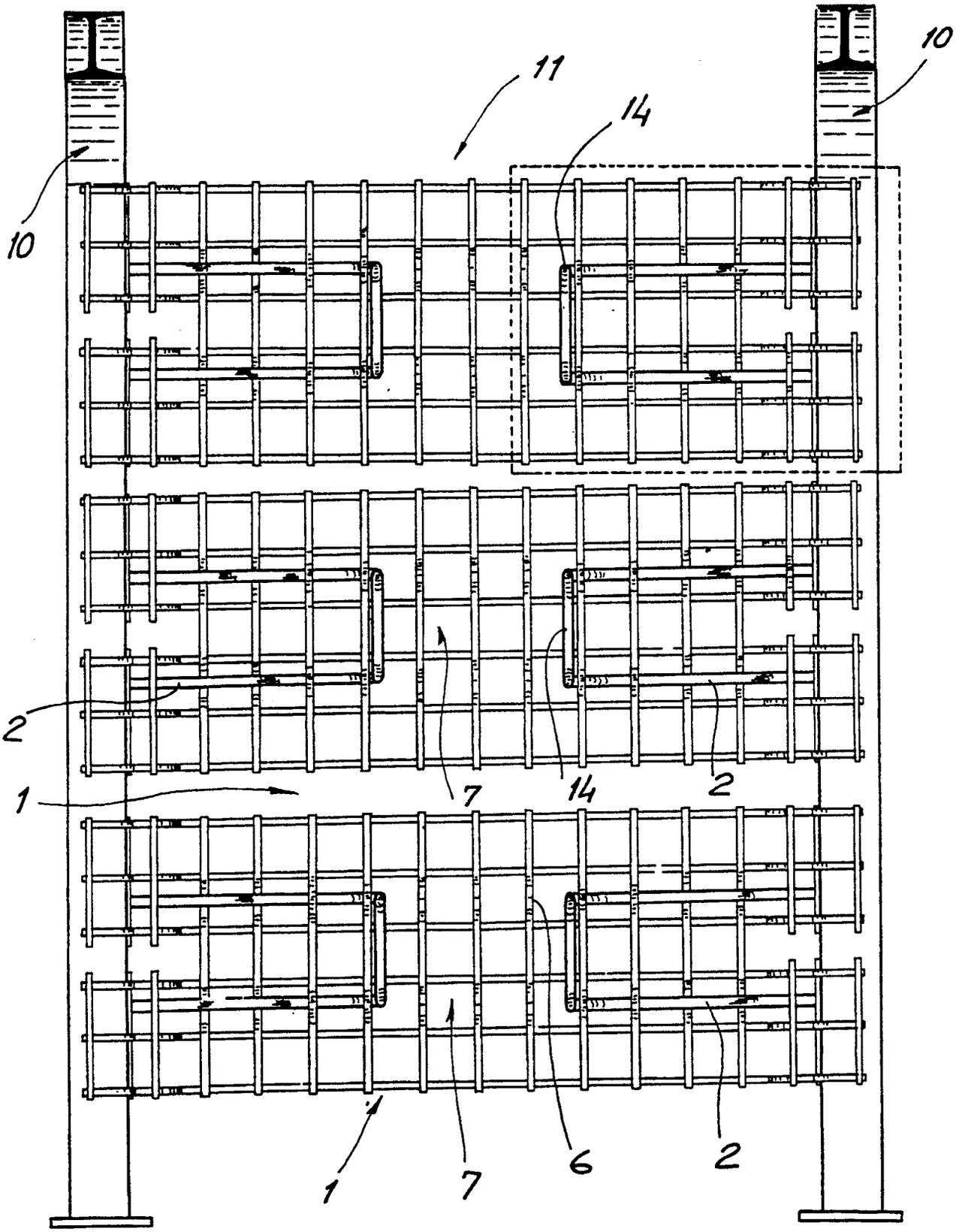


Fig. 1

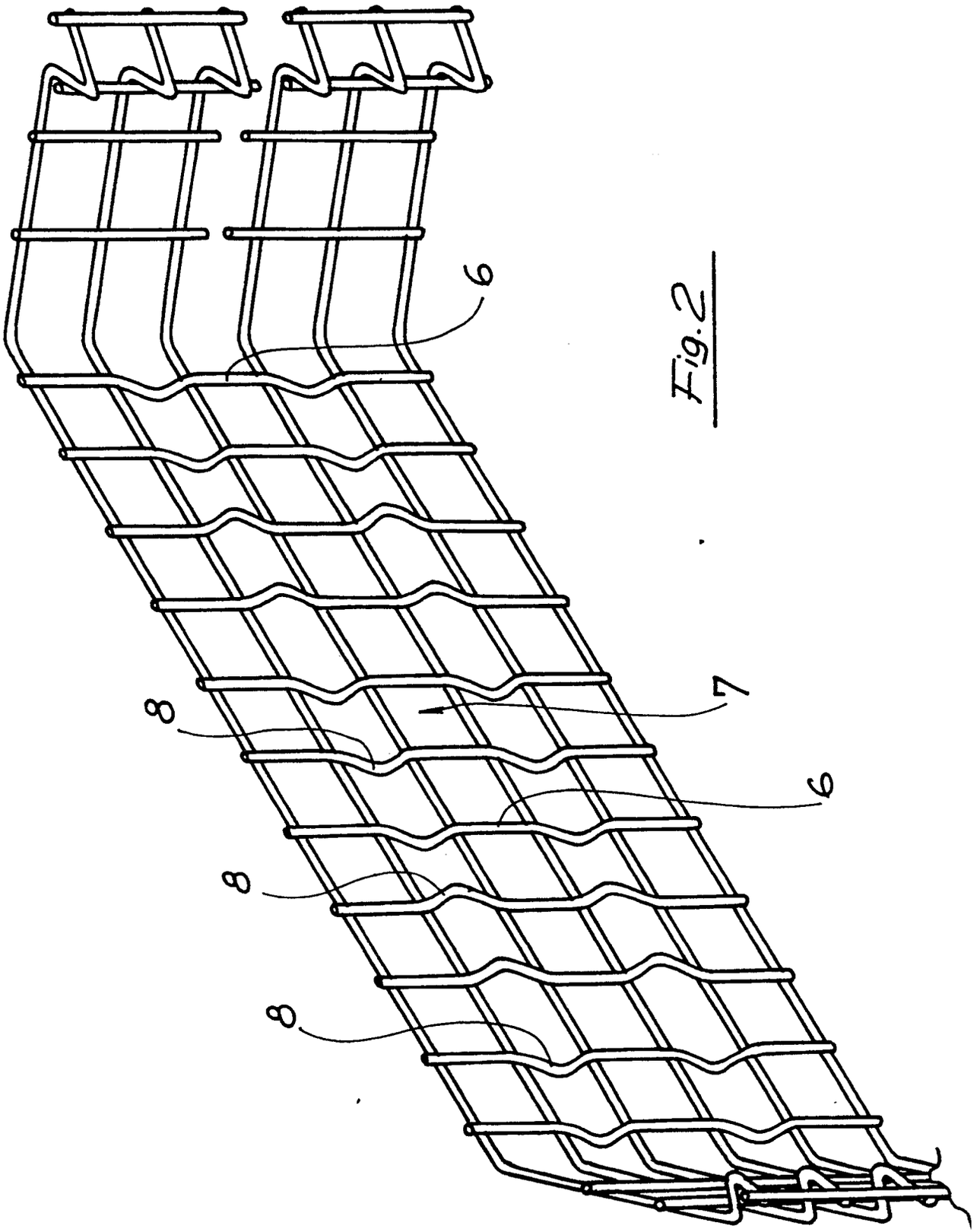


Fig.2

Fig. 3

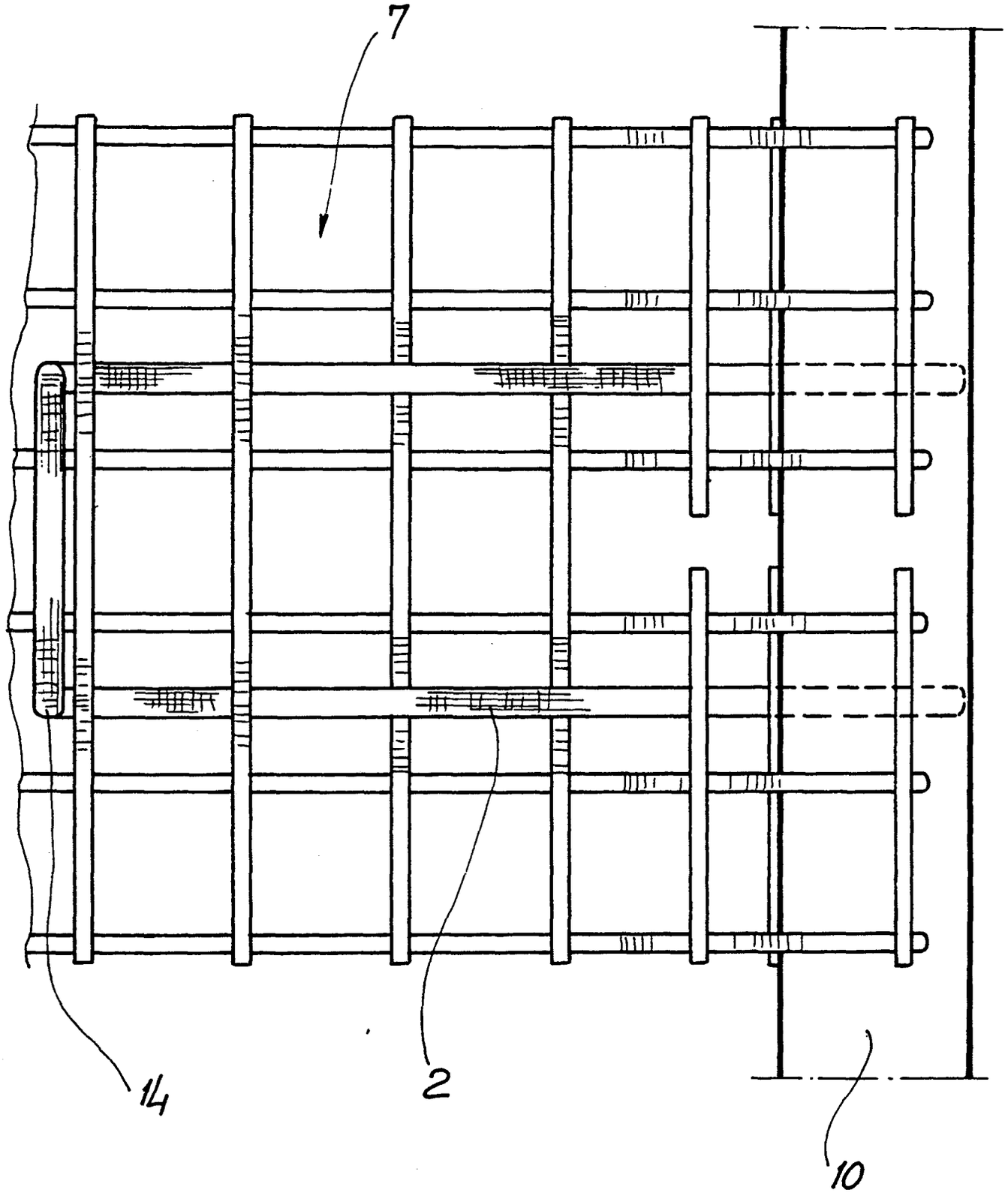
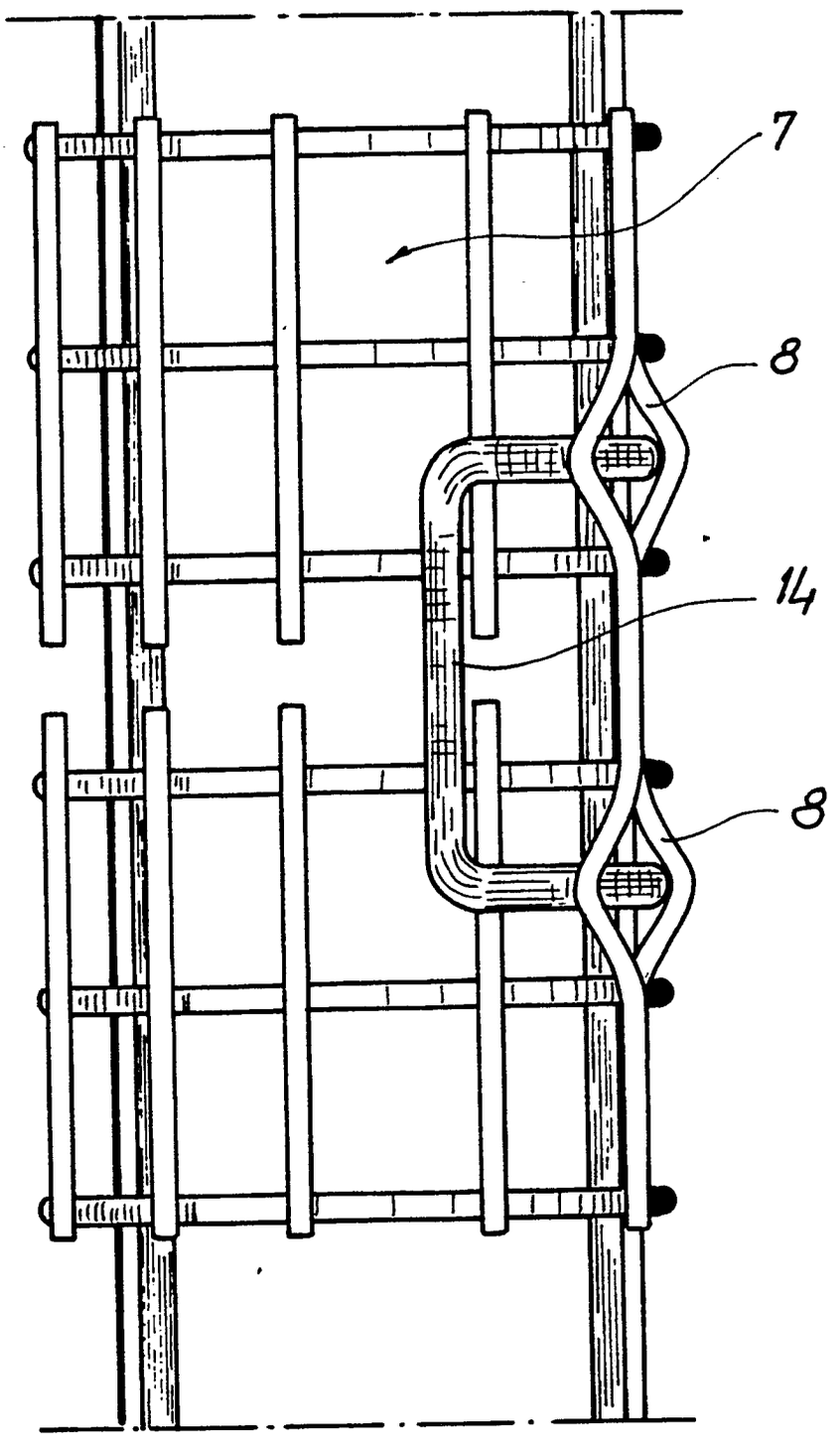


Fig. 4



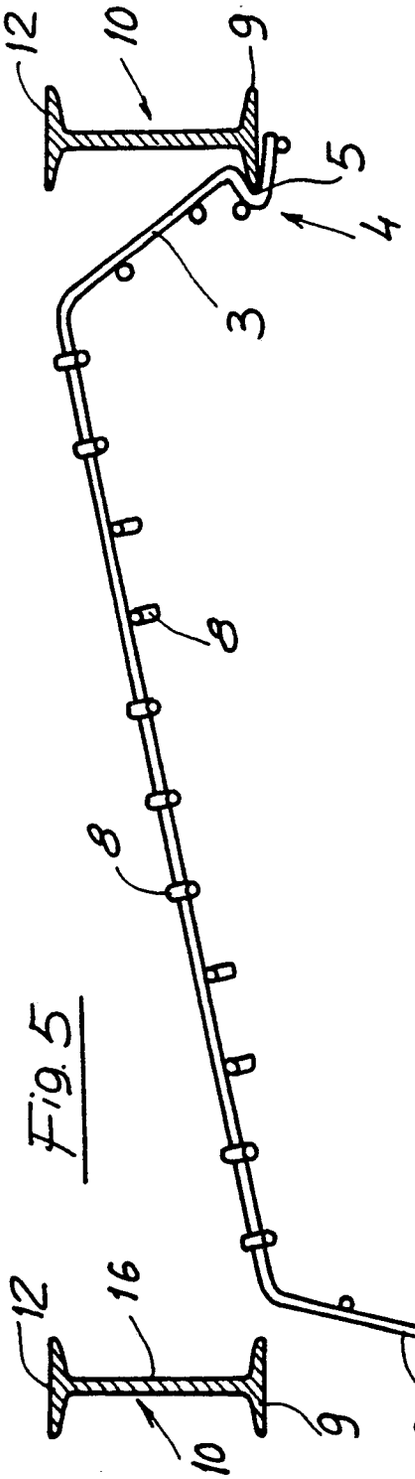


Fig. 5

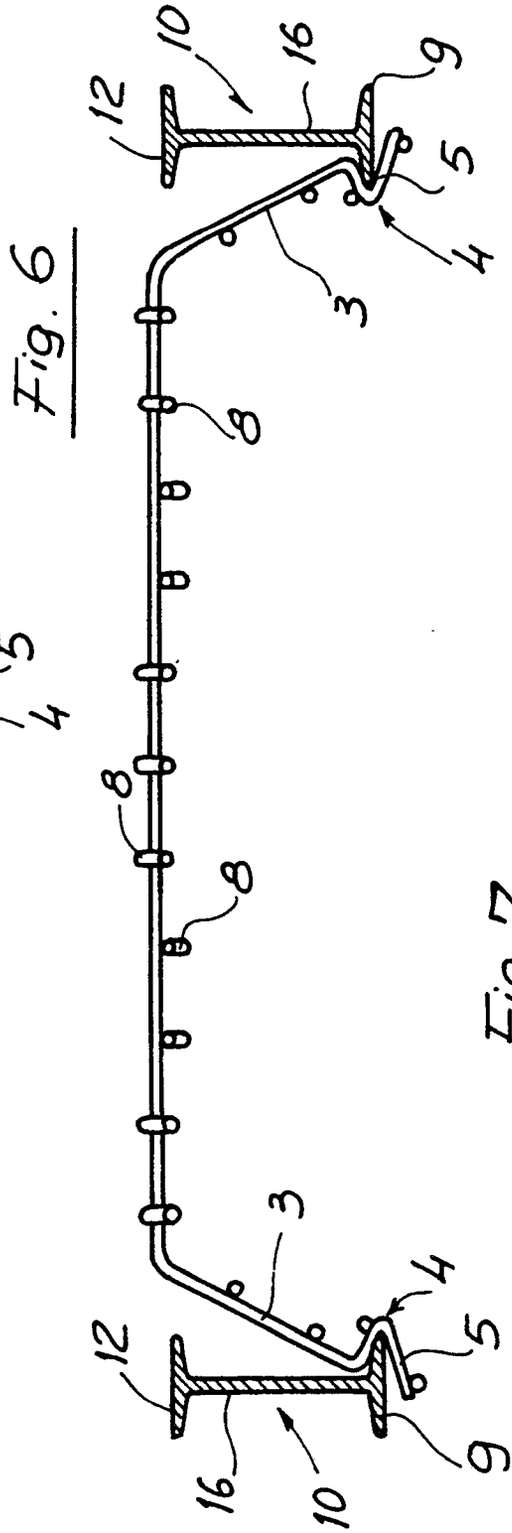


Fig. 6

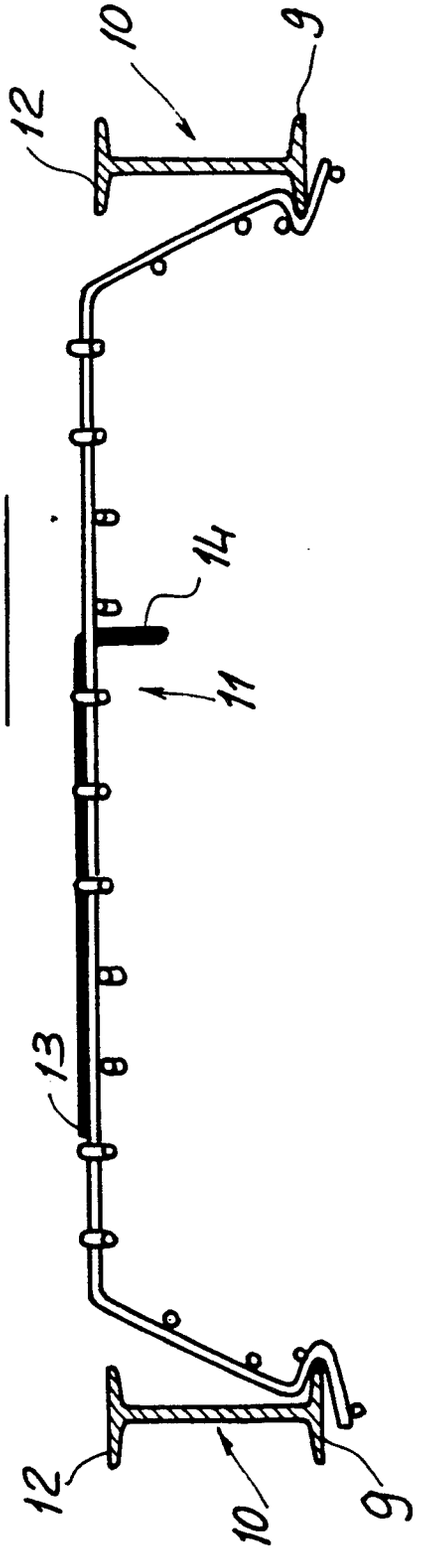


Fig. 7

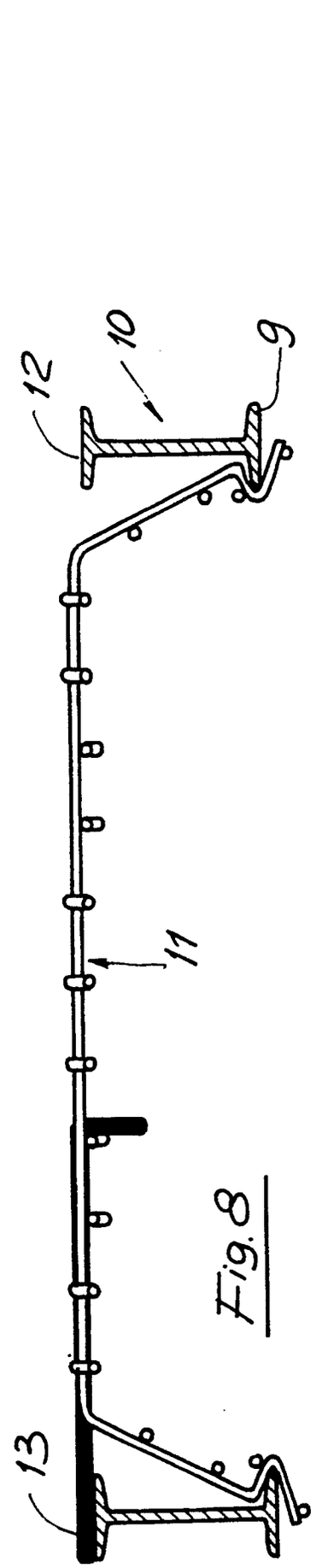


Fig.8

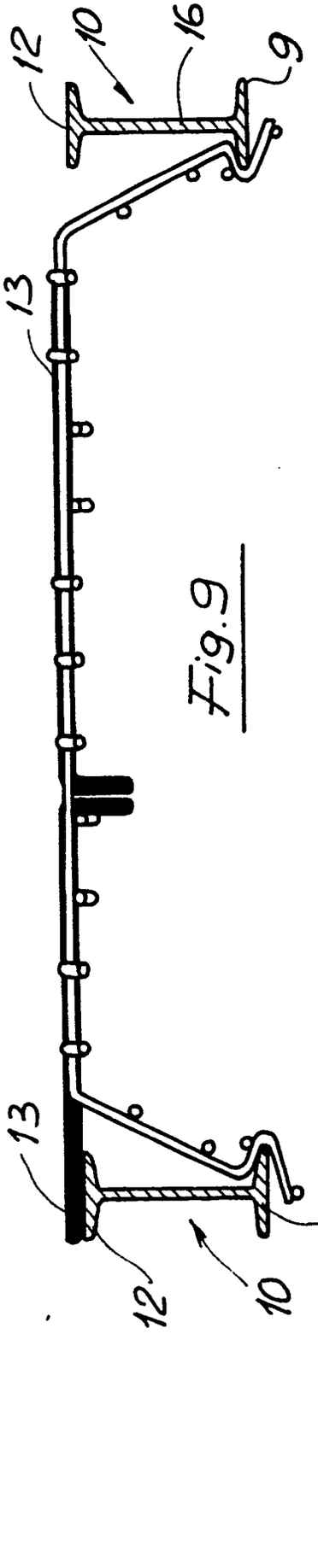


Fig.9

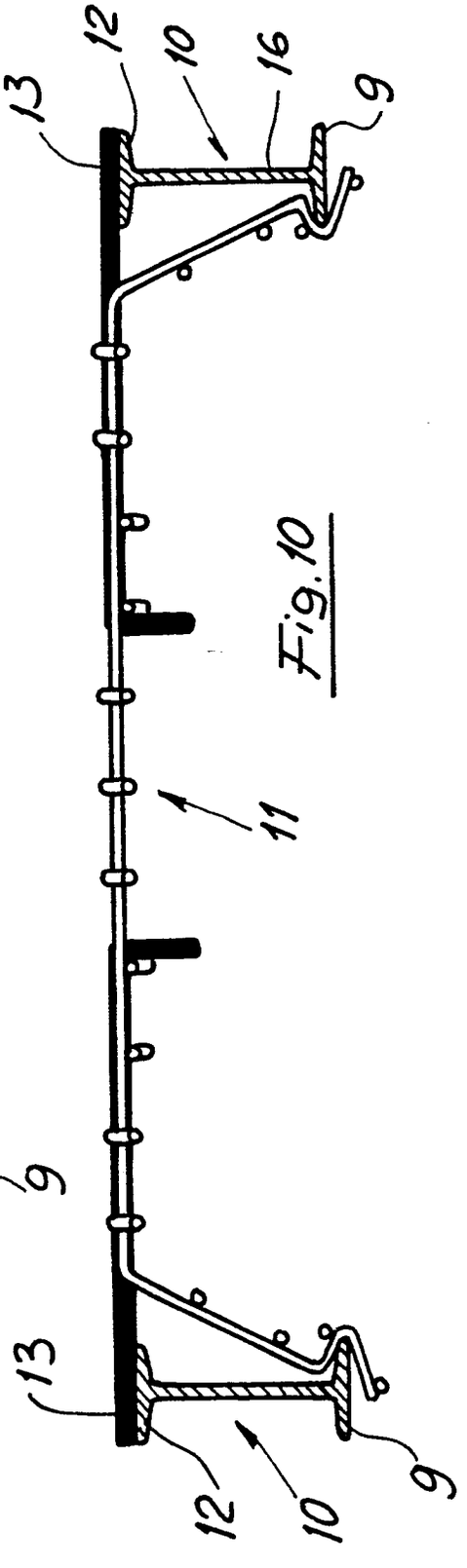


Fig.10

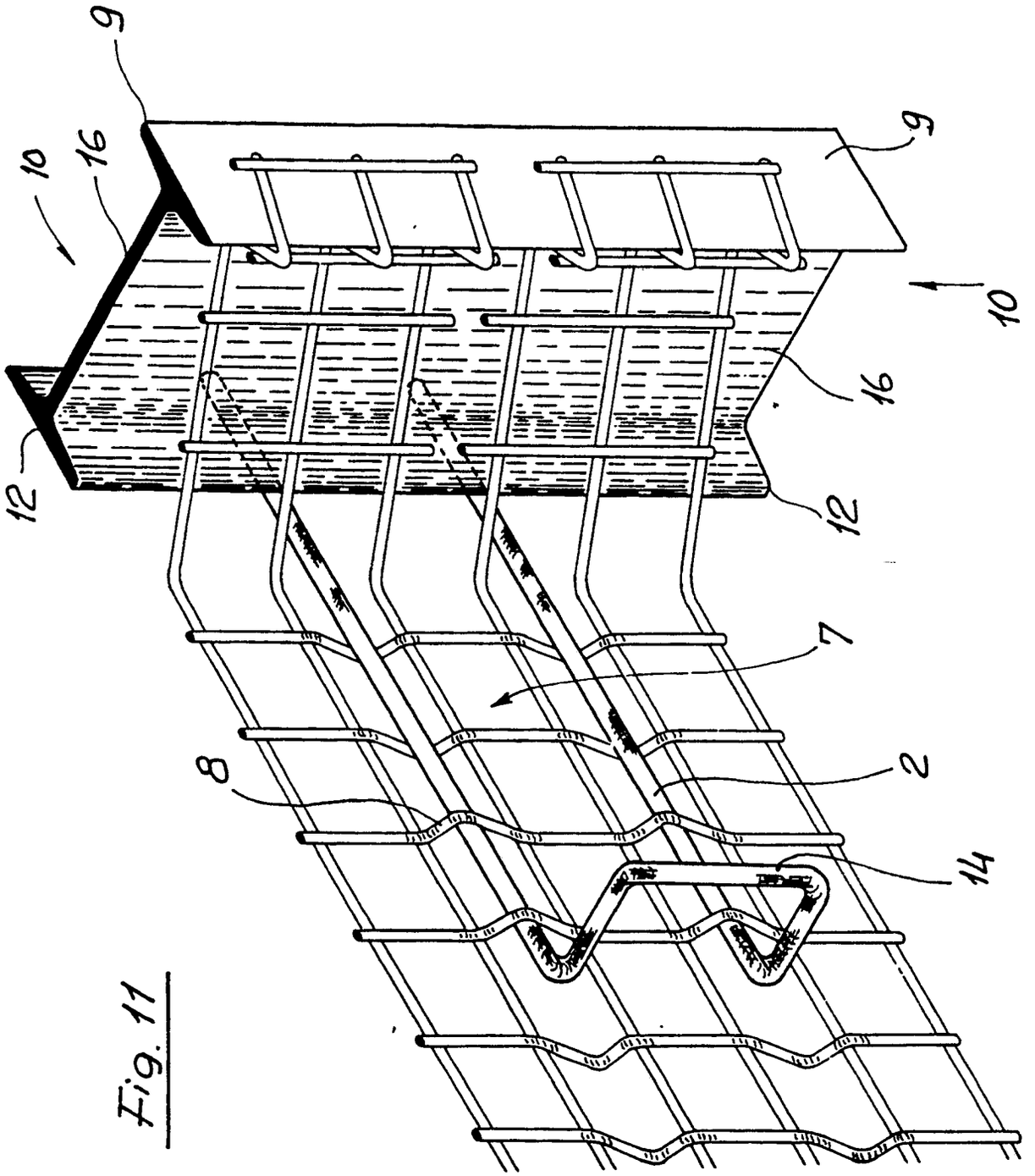


Fig. 11

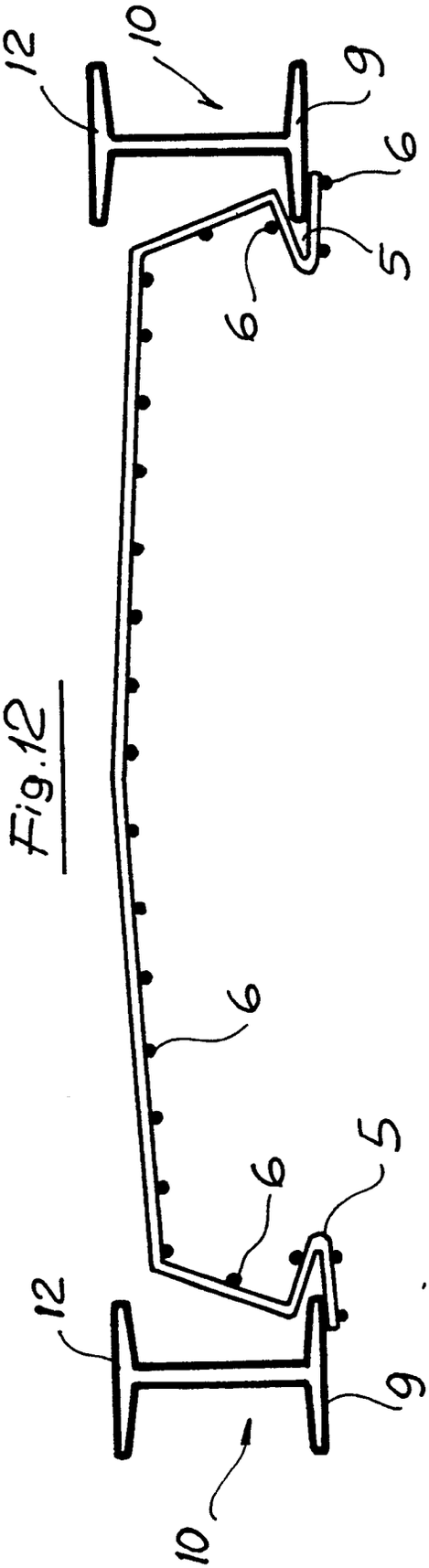


Fig.12

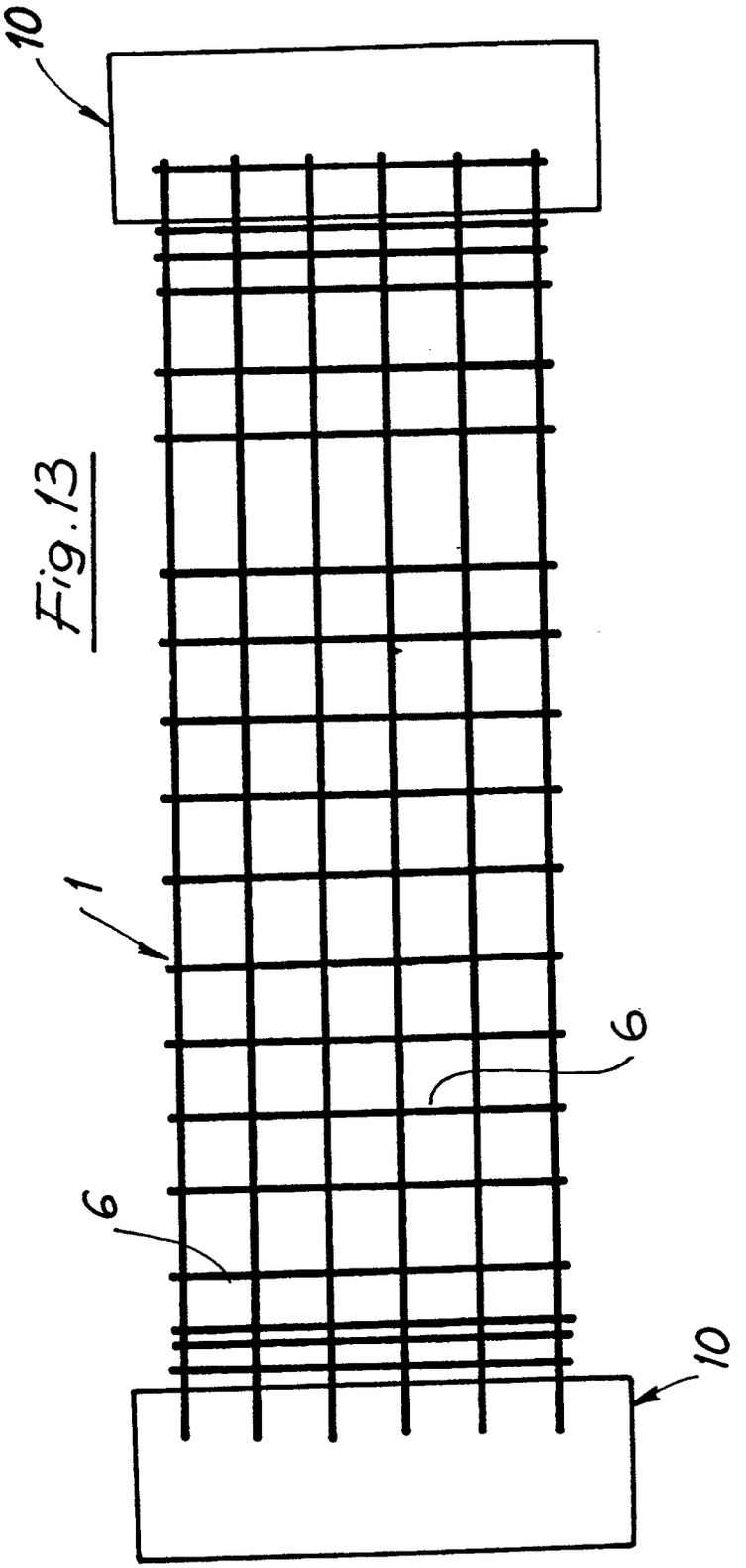


Fig.13

Fig.14

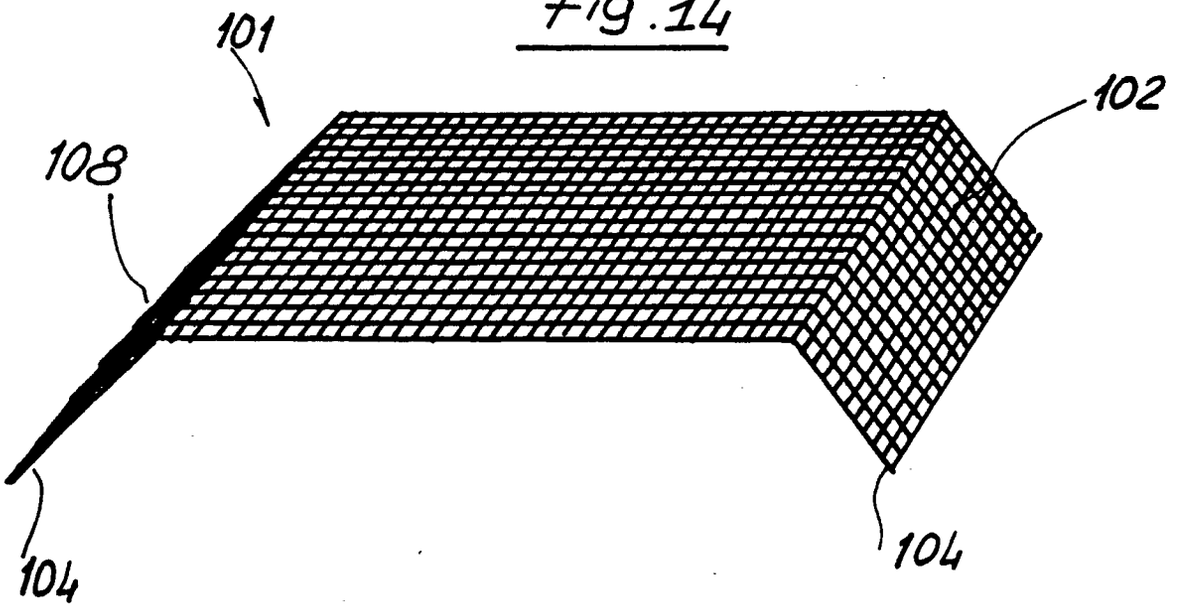
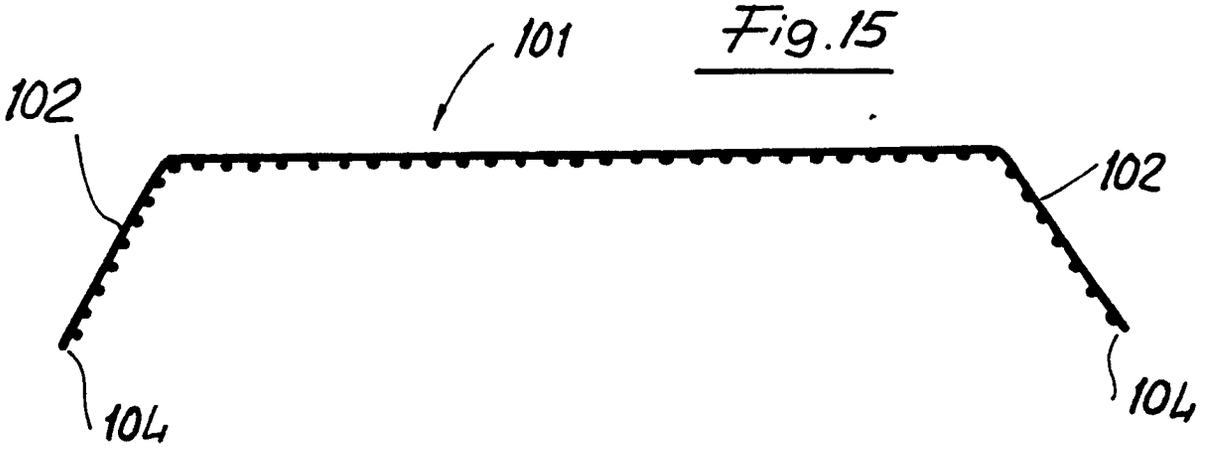


Fig.15



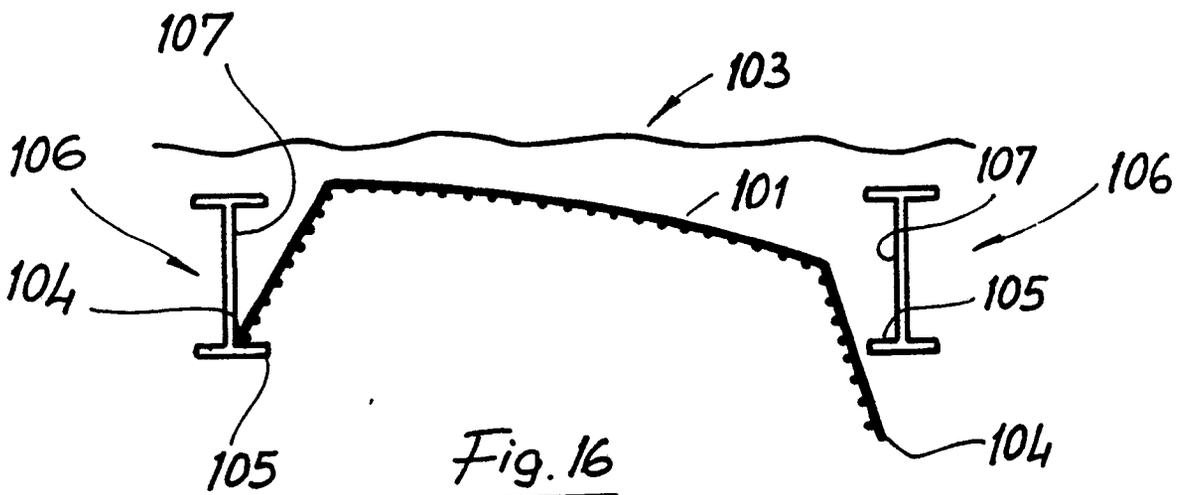
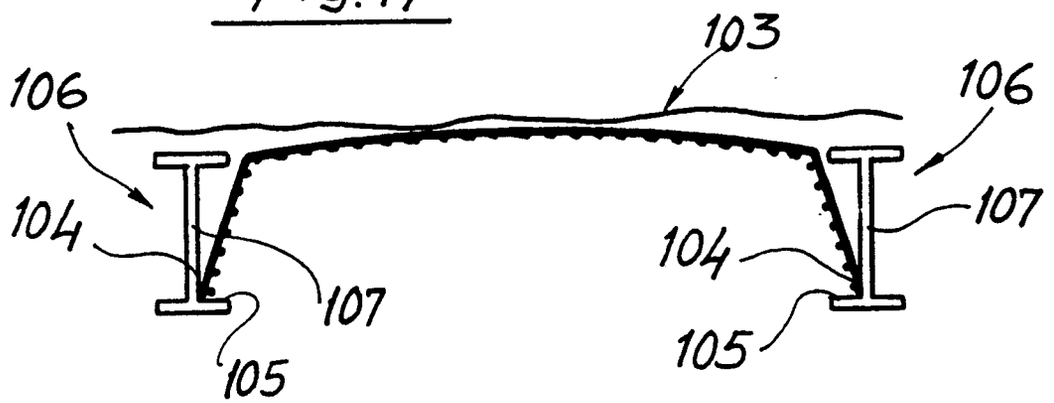


Fig.16

Fig. 17



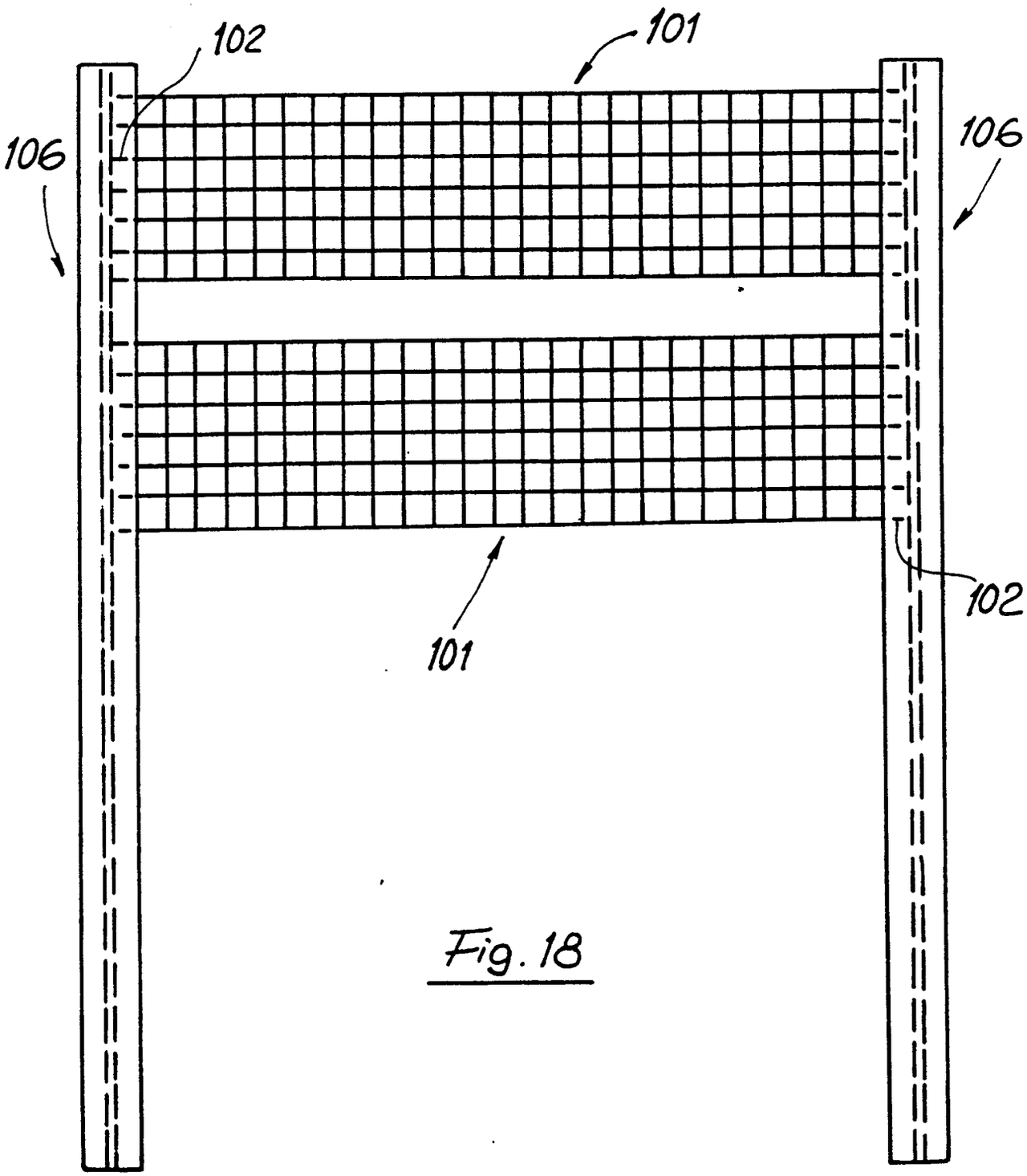


Fig. 18

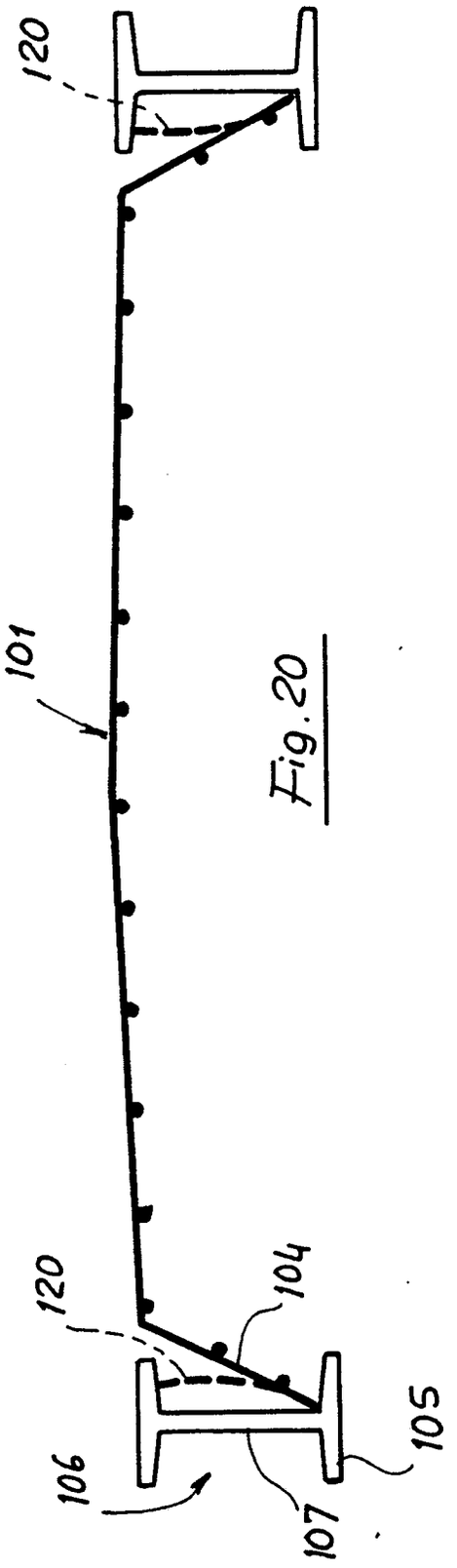


Fig. 20

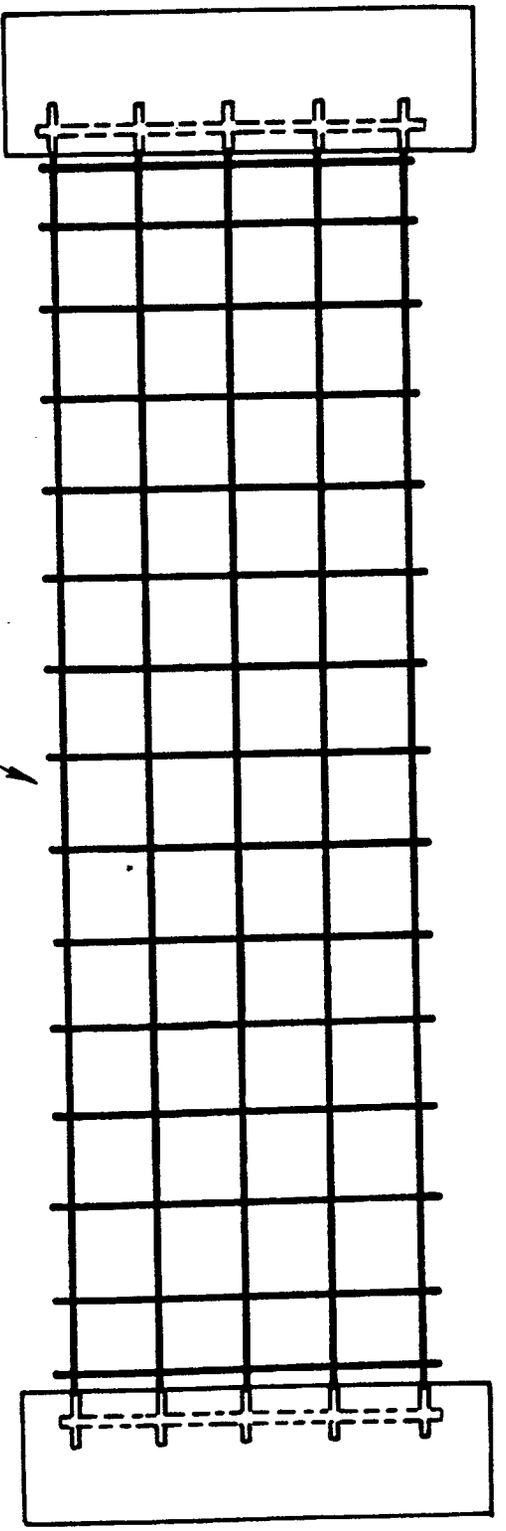


Fig. 21

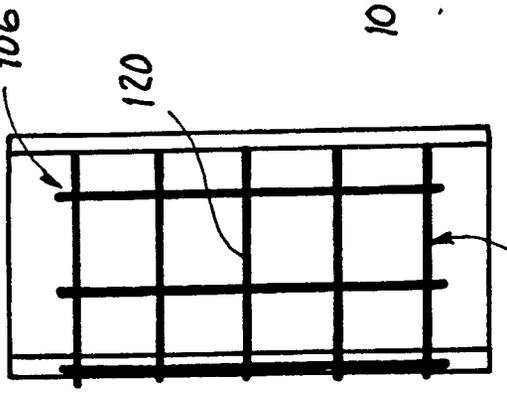


Fig. 19